

CLAIMS

We claim:

1        1. A cellular network comprising:  
2              a plurality of subscribers communicating with the base station using  
3              orthogonal frequency division multiple access (OFDMA);  
4              at least one base station having logic to coordinate multiple-access  
5              and information exchange between the at least one base station and the  
6              plurality of subscribers, the logic selecting a set of OFDMA traffic channels  
7              from a plurality of candidate OFDMA traffic channels based on feedback  
8              channel information collected from the plurality of subscribers.

1        2. The network defined in Claim 1 wherein the logic calculates  
2              spatial gains of uplink and downlink channels based on responses of  
3              spatially separated receivers at the base station.

1        3. The network defined in Claim 1 wherein the feedback  
2              information comprises channel fading information and noise and  
3              interference levels for each of the plurality of candidate OFDMA traffic  
4              channels.

1           4.     The network defined in Claim 1 wherein the plurality of  
2     subscribers send the feedback information in response to a sounding signal  
3     from the at least one base station.

1           5.     The network defined in Claim 1 wherein the at least one base  
2     station selects a combination of modulation and coding schemes based on  
3     the SINR of the selected traffic channel for each accessing subscriber.

1           6.     The network defined in Claim 1 wherein the logic comprises  
2     medium access control (MAC) logic.

1           7.     A method comprising:  
2         sending sounding signals to a plurality of subscribers;  
3         receiving channel condition information for a plurality of OFDMA  
4     traffic channels; and  
5         performing OFDMA multi-user traffic channel assignment to assign  
6     traffic channels from the plurality of OFDMA traffic channels to the plurality  
7     of subscribers based on the channel condition information and estimated  
8     spatial gains for the uplink and downlink signals.

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1           8.     The method defined in Claim 7 wherein the channel condition  
2     information comprises information regarding estimated channel gains and  
3     channel interference for the plurality of OFDMA traffic channels.

1           9.     The method defined in Claim 7 wherein performing traffic  
2     channel assignment is based on channel conditions between one or more  
3     antennas at a base station and one or more antennas at subscriber locations.

1           10.    The method defined in Claim 7 further comprising estimating  
2     spatial gains for uplink and downlink signals.

1           11.    The method defined in Claim 10 further comprising estimating  
2     signal-to-noise-plus-interference rates (SINRs) for the uplink and downlink  
3     signals, and wherein performing channel assignment is based on the SINRs  
4     for the uplink and downlink signals.

1           12.    The method defined in Claim 11 wherein estimating SINRs for  
2     the uplink and downlink signals is performed on all OFDMA traffic  
3     channels for all active and accessing subscribers.

1           13.     The method defined in Claim 11 wherein performing channel  
2     assignment is based on quality of service (QoS) requirements.

1           14.     The method defined in Claim 13 wherein the QoS  
2     requirements include one or more of the following: data rate, time-out, bit  
3     error rate, and writing time.

1           15.     The method defined in Claim 13 wherein performing channel  
2     assignment is based on priority.

1           16.     The method defined in Claim 7 further comprising  
2     determining a combination of coding and modulation schemes when  
3     performing channel assignments.

1           17.     The method defined in Claim 7 wherein performing traffic  
2     channel assignments comprises a plurality of base stations coordinating to  
3     perform the traffic channel assignment.

1        18.     The method defined in Claim 17 wherein each of the plurality  
2     of base stations is within a cell and estimates SINRs for uplink and downlink  
3     signals across all OFDMA traffic channels for accessing subscribers

1        19.     The method defined in Claim 18 when the plurality of base  
2     stations perform estimates for active and accessing subscribers.

1        20.     The method defined in Claim 7 wherein the sounding signal is  
2     omni-directional.

1        21.     The method defined in Claim 7 wherein estimating spatial  
2     gains for uplink and downlink signals comprises:  
3                estimating broadband spatial channels across the plurality of OFDMA  
4                traffic channels for each accessing subscriber;  
5                determining the spatial processing gains for uplink and downlink  
6                signals on each of the plurality of OFDMA traffic channels;  
7                predicting signal-to-noise-plus-interference ratio (SINR) for uplink  
8                and downlink transmission with spatial processing over each of available

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9       OFDMA traffic channels by adding the spatial processing gain to downlink  
10      signal strength feedback from one or more subscribers.

1           22.     A method comprising:  
2              receiving channel characteristics and noise-plus-interference  
3              information measured at spatially distributed subscribers; and  
4              assigning traffic channels for an orthogonal frequency-division  
5        multiple-access (OFDMA) network.

1           23.     The method defined in Claim 22 wherein assigning traffic  
2        channels is performed for the OFDMA network that uses spatial  
3        multiplexing.

1           24.     A method comprising:  
2              each of a plurality of subscribers estimating channel gains and noise-  
3              plus-interference levels of a set of OFDMA traffic channels in response to a  
4        sounding signal;  
5              the plurality of subscribers transmitting to a base station measured  
6        channel and noise-plus-interference information;

7           at least one of the plurality of subscribers transmitting packets using  
8       one or more allocated OFDMA traffic channels.

1           25.     The method defined in Claim 24 wherein the plurality of  
2       subscribers transmit the measured channel and noise-plus-interference  
3       information on pre-allocated channels.

1           26.     The method defined in Claim 24 wherein the plurality of  
2       subscribers transmits the measured channel and noise-plus-interference  
3       information when paged or when one or more of the plurality of subscribers  
4       have a packet to transmit to the base station.

1           27.     An apparatus comprising:  
2       a channel and noise-plus-interference estimator;  
3       an access signal generator coupled to the estimator;  
4       an OFDM modem coupled to the generator.

1        28.     The apparatus defined in Claim 27 wherein the estimator  
2     estimates channel gains and noise-plus-interference levels in a pre-  
3     determined set of traffic channels.

1        29.     The apparatus defined in Claim 28 wherein the generator  
2     encodes channel and noise-plus-interference information to form an access  
3     signal.

1        30.     The apparatus defined in Claim 29 wherein the OFDM modem  
2     modulates the access signal and transmits a modulated version of the access  
3     signal through an access channel.

1        31.     The apparatus defined in Claim 30 wherein the access channel  
2     comprises at least a subset of all traffic channels during an access time slot.

1        32.     An apparatus comprising:  
2              at least one spatially separated transceiver;  
3              an access signal detector and demodulator coupled to the at least one  
4     spatially separated transceivers;

5        a spatial channel and spatial gain estimator;  
6        an uplink and downlink signal-to-noise-plus-interference estimator;  
7        a multi-user traffic channel allocator coupled to the calculator, and  
8        the estimator; and  
9        an OFDM modem coupled to the allocator.

1        33.      The apparatus defined in Claim 32 wherein the allocator  
2        determines traffic channel assignment and a code and modulation  
3        combination for each accessing subscriber, and the OFDM modem  
4        modulates the traffic channel assignment and transmits a modulated version  
5        of the traffic channel assignment to at least one subscriber.

1        34.      The apparatus defined in Claim 33 wherein the allocator  
2        determines traffic channel assignment based on broadband spatial channel  
3        estimates from the estimator and measured channel and noise-plus-  
4        interference information feedback from subscribers.

1        35.     The apparatus defined in Claim 34 wherein the broadband  
2     spatial channel estimates comprise the broadband spatial channel between a  
3     base station and each accessing subscriber.

1        36.     The apparatus defined in 34 wherein the access signal detector  
2     and demodulator detects access signals transmitted by subscribers and  
3     demodulates the measured channel and noise-plus-interference information  
4     feedback from subscribers.